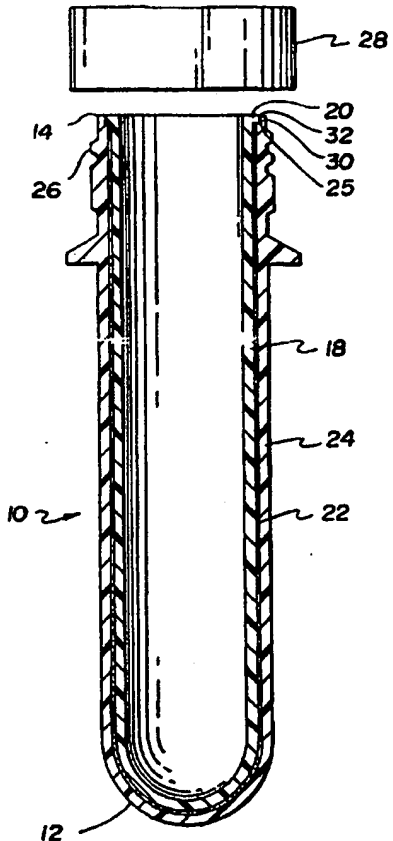


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<p>(21) International Application Number: PCT/US94/04610 (22) International Filing Date: 27 April 1994 (27.04.94) (30) Priority Data: 08/079,368 18 June 1993 (18.06.93) US (71) Applicant: PLASTIPAK PACKAGING, INC. [US/US]; P.O. Box 2500 C, 9135 General Court, Plymouth, MI 48170 (US). (72) Inventors: DARR, Richard, C.; 3645 Good Road, Seville, OH 44273 (US). SLAT, William, A.; 164 North Grand Pointe, Brooklyn, MI 48230 (US). (74) Agent: KUSHMAN, James, A.; Brooks &amp; Kushman, 22nd floor, 1000 TOWN Center, Southfield, MI 48075 (US).</p>		<p>(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report.</p>
<p>(54) Title: MULTI-LAYER PREFORM FOR PLASTIC BLOW MOLDING</p> <p>(57) Abstract</p> <p>A multi-layer plastic preform (10) for use in plastic blow molding includes an injection molded inner layer (18) of virgin plastic having an outwardly extending annular flange (20) at an open end (14) of the preform. An injection molded outer layer (24) of post consumer recycled plastic covers the inner layer (18) and has a thread (26) for securing a closure, and this thread (26) is located toward the closed end (12) of the preform from the annular flange (20) of the inner layer (18) to thereby provide a construction that allows increased use of the recycled plastic. The preform (10) may be provided with an intermediate layer (22) of a gas barrier material when the container to be blow-molded from the preform is to be used to hold gas pressurized liquids such as soft drinks.</p> 		

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## MULTI-LAYER PREFORM FOR PLASTIC BLOW MOLDING

### Technical Field

5 This invention relates to a multi-layer plastic preform for use in plastic blow molding.

### Background Art

10 Plastic blow molding is conventionally performed by providing a hot plastic parison either from extruded plastic or as a preform which is usually injection molded from plastic. Usually, such preforms are composed of a single type of plastic that is injected into a mold through a single port. However, there have also been attempts to provide coinjection of more than one plastic into a mold so as to provide different layers of plastic.

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20 U.S. Patent 3,878,282 to Bonis et al. discloses a process for molding multi-layer articles that are specifically disposed as a preform-type parison with different layers. The process involved is performed by injection molding the different layers within different molds while mounted on the same inner mandrel during the injection of each layer.

25 U.S. Patent 4,307,137 to Ota et al. discloses a method for forming an optical design pattern in polyethylene terephthalate articles which are specifically disclosed as a blow molding preform having inner and outer members with the inner member having an open end defining a thread closure and with the outer member

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having a junction with the inner member toward a closed end of the preform from the thread closure.

5 U.S. Patent 4,391,861 to Nilsson discloses a preform of a thermoplastic and has a two-part inter-fitted construction and at least one intermediate layer that functions as a gas barrier, and also discloses that the outer part may be previously used and reprocessed material.

10 U.S. Patent 4,646,925 to Nohara discloses a multi-layer preform for draw-blow forming a bottle which has inner and outer layers with a junction that is located toward a closed end of the preform from a closure thread at an open end of the preform. The preform also includes a gas barrier intermediate the  
15 inner and outer layers.

There have also been attempts in the past to utilize post consumer recycled plastic since such reuse reduces the need for additional land fills as well as conserving on natural resources in the manufacturing of  
20 new articles.

### Disclosure Of Invention

An object of the present invention is to provide an improved multi-layer plastic preform for use in plastic blow molding. The preform generally has a  
25 conventional shape including a tubular shape with a closed end and an open end.

In carrying out the above and other objects of the invention, the plastic preform includes an injection molded inner layer of virgin plastic having an outwardly

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extending annular flange at the open end of the preform. An injection molded outer layer of post consumer recycled plastic covers the inner layer and has a thread for securing a closure, and the thread is located toward the  
5 closed end of the preform from the annular flange of the inner layer.

The construction of the multi-layer plastic preform allows increased use of post consumer recycled plastic by virtue of the outer layer defining the  
10 closure thread at the open end of the preform as well as defining a portion of the tubular shape and the other closed end.

In the preferred construction of the multi-layer plastic preform of the invention, the inner layer  
15 and the outer layer are each injection molded from polyethylene terephthalate.

The preferred construction of the preform also includes a thin intermediate layer of a gas barrier located between the inner and outer layers. Further-  
20 more, the intermediate layer that provides the gas barrier is most preferably ethylene-vinyl alcohol.

In the preferred construction, the multi-layer plastic preform has the outer layer at the open end of the preform provided with an annular axially extending  
25 flange that surrounds the annular flange of the inner layer and cooperates therewith to define a closure sealing surface of an annular shape.

The objects, features and advantages of the present invention are readily apparent from the follow-  
30 ing detailed description of the best mode for carrying

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out the invention when taken in connection with the accompanying drawings.

### Brief Description Of Drawings

FIGURE 1 is a sectional view taken through a multi-layer plastic preform constructed in accordance with the present invention;

FIGURE 1a is an enlarged view of a portion of a wall of the preform showing an inner layer of virgin plastic, an intermediate layer of a gas barrier material and an outer layer of post consumer recycled plastic;

FIGURE 2 is a view illustrating mold apparatus utilized to manufacture the preform and shown during injection molding of the inner layer of virgin plastic;

FIGURE 3 is a view of the apparatus at a further state during application of the gas barrier intermediate layer in preparation for the injection molding of the outer layer; and

FIGURE 4 is a view of the apparatus at a further stage during the injection molding of the outer layer of post consumer recycled plastic.

### Best Mode For Carrying Out The Invention

With reference to Figure 1 of the drawings, a multi-layer plastic preform for use in plastic blow molding is generally indicated by 10 and has a generally conventional shape including a closed end 12 and an open end 14. This preform 10 is manufactured by different

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stages of injection blow molding by mold apparatus 16 shown in Figures 2, 3 and 4, which are hereinafter more fully described.

5 The multi-layer plastic preform 10 of this invention, as shown in Figure 1, includes an inner layer 18 of virgin plastic having an outwardly extending annular flange 20 at the open end 14 of the preform. As illustrated, the preform 10 also has a thin intermediate layer 22 composed of a gas barrier material that covers  
10 the exterior of the inner layer 18 from just below the annular flange 20 thereof to the closed end of the preform. This intermediate layer is used when the preform is to be blow molded to a container for holding gas pressurized liquids, i.e. soft drinks. However, for  
15 other applications such as for holding food or cleaning products, the gas barrier intermediate layer may not be necessary.

An injection molded outer layer 24 of the preform 10 is composed of post consumer recycled plastic  
20 that covers the intermediate layer 22. When the gas barrier intermediate layer 22 is utilized, there is a direct connection 25 of the outer layer 24 with the flange 20 of the inner layer 18 to enclose the gas barrier intermediate layer 22. This prevents the  
25 intermediate layer 22 from absorbing moisture from the atmosphere. This outer layer 24 as in hereinafter more fully described is injection molded in situ over the inner layer 18 and has a thread 26 for securing a closure 28 by threading of a female thread thereof onto  
30 the exterior male thread of the preform. The thread 26 of the outer layer 24 of the preform is located toward the closed end 12 of the preform from the annular flange 20 of the inner layer 18. This construction of the

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preform allows increased use of the post consumer recycled plastic as compared to prior constructions of multi-layer plastic preforms.

5 In the preferred construction of the multi-layer plastic preform, the inner layer 18 and the outer layer 24 are each injection molded from polyethylene terephthalate. Furthermore, when the gas barrier intermediate layer 22 is utilized, it is preferably composed of ethylene-vinyl alcohol.

10 With continuing reference to Figure 1, the multi-layer plastic preform is preferably constructed with the outer layer 24 at the open end 14 of the preform having an annular axially extending flange 30 that surrounds the annular flange 20 of the inner layer  
15 18 and cooperates therewith to define a closure sealing surface 32 of an annular shape.

The manufacturing of the preform 10 will now be described in connection with Figures 2 through 5. Initially, the mold apparatus 16 is utilized to injection mold the inner layer 18 as shown in Figure 2. More  
20 specifically, this apparatus 16 includes an inner core 34 on which each cycle of the injection molding is performed. More specifically, this core 34 is mounted on a support 36 and extends therefrom to a distal end 38 at which the closed end of the finally molded preform is  
25 located as is hereinafter more fully described. A first cavity mold 40 of the apparatus includes a mold member 42 having a cavity 44 that receives the core 34. A flange mold 46 of the apparatus has a pair of movable  
30 mold members 48 with a junction 50 in the closed position for defining a flange cavity 52. Mold member 42 includes an injection port 54 through which hot plastic



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resin is injected to thus provide the inner layer 18 with the flange 20 as previously described. Relative movement between the cavity mold 40 and the other mold components then withdraws the inner layer 18 from the mold cavity 44. During this withdrawal, the flange 20 allows the flange mold 46 to maintain the inner layer 18 on the core 34 without slippage despite friction generated with the mold cavity 44. Thereafter, the mold members 48 are moved away from each other so that the inner layer 18 is ready for further processing.

With reference to Figure 3, the molded inner layer 18 may then be processed by application of the intermediate layer 22 when the container to be blow molded from the preform 10 is to hold gas pressurized liquids. This application can be performed by a suitable coating device 56 that may dip, spray or brush, etc. the gas barrier intermediate layer 22 onto the exterior of the inner layer 18 from a location just below the flange 20 thereof to and covering the closed end of the inner layer. The gas barrier intermediate layer prevents the escape of gas, e.g. CO<sub>2</sub>, to thereby prolong the product lifetime.

With continuing reference to Figure 3, a second cavity mold 58 includes a mold member 60 having a cavity 62 for receiving the previously injection molded inner layer 18 with or without the intermediate layer 22 of the gas barrier. The mold apparatus also includes a thread mold 64 having a pair of mold members 66 with a junction 68 in a closed position. The mold members 66 are movable as shown in Figure 4 by arrows 70 in opposite directions so as to allow the molded inner layer 18 with the flange 20 thereof to be received within the cavity 62 of the mold 58. The closed mold

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members 66 define a thread cavity 72 for molding the thread 26 of the outer layer 24. Mold member 60 includes an injection port 74 through which the post consumer recycled plastic is injected into the cavity 62 to injection mold the outer layer 24 with the thread 26 constructed as previously described. Thereafter, relative movement between the cavity mold 58 and the other mold components withdraws the molded preform from cavity 62. Further relative movement between the support 36 and the thread mold 64 then removes the preform 10 from the core 34. Finally, movement of the thread mold members 66 away from each other releases the molded preform 10.

It should be noted that the location of the preform flange 20 along the core 34, rather than being spaced from the support 36 as shown, can be engaged with the support 36 which thus functions as a mold cavity defining surface during both stages of the injection molding. Thus, the flange mold 46 and the thread mold 64 will then be thinner than the molds illustrated where there is a spacing along the core 34 between the preform flange 20 and mold support 36.

It should also be noted that the outer layer of post consumer recycled plastic preferably constitutes at least 50% of the volume of the preform and, most preferably constitutes a greater percentage such as 70% to 90%. The amount of recycled plastic that can be utilized, while still having a sufficiently thick inner layer 18 of virgin plastic to protect product held by a subsequently blow molded container, can be greater than is possible with conventional constructions due to the manner in which the thread 26 is constructed from the recycled plastic.

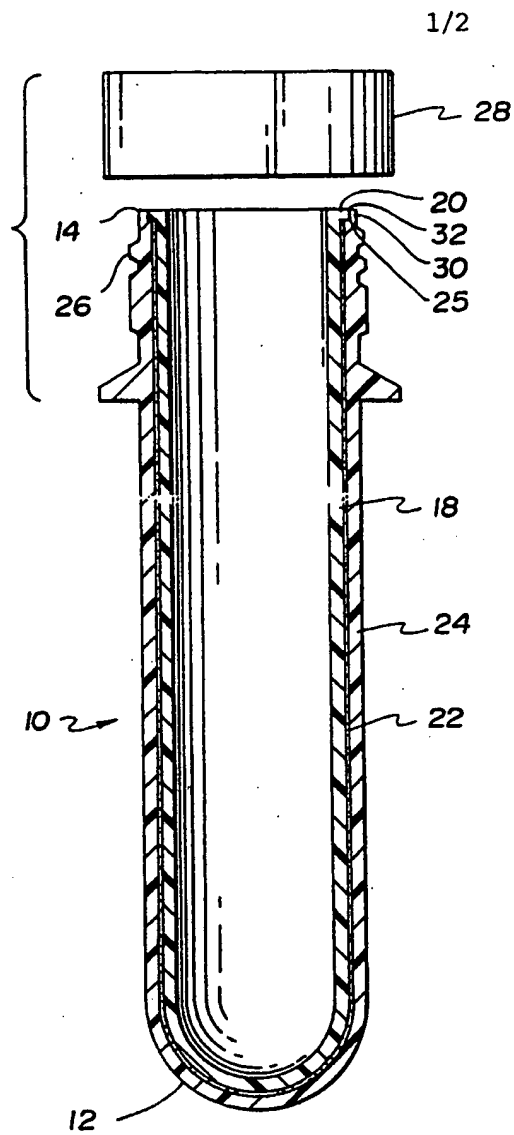
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While the best mode for carrying out the invention has been described in detail, those familiar with the art to which this invention relates will recognize various alternative designs and embodiments for practicing the invention as defined by the following claims.

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**What Is Claimed Is:**

1. A multi-layer plastic preform for use in plastic blow molding, the preform having a tubular shape including a closed end and an open end, the preform comprising:
  - an injection molded inner layer of virgin plastic having an outwardly extending annular flange at the open end of the preform; and
  - an injection molded outer layer of post consumer recycled plastic that covers the inner layer and has a thread for securing a closure, and the thread being located toward the closed end of the preform from the annular flange of the inner layer.
2. A multi-layer plastic preform as in claim 1 wherein the inner layer and the outer layer are each injection molded from polyethylene terephthalate.
3. A multi-layer plastic preform as in claim 1 or 2 which also includes a thin intermediate layer of a gas barrier located between the inner and outer layers.
4. A multi-layer plastic preform as in claim 1 wherein the gas barrier intermediate layer is ethylene-vinyl alcohol.
5. A multi-layer plastic preform as in claim 1 wherein the outer layer at the open end of the preform has an annular axially extending flange that surrounds the annular flange of the inner layer and cooperates therewith to define a closure sealing surface of an annular shape.



*Fig. 1*

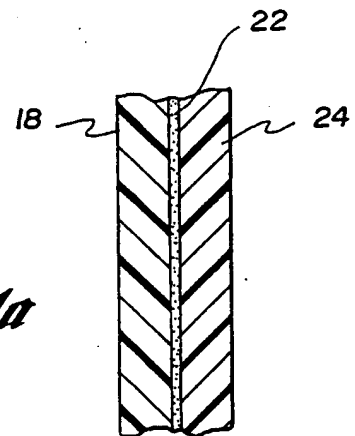
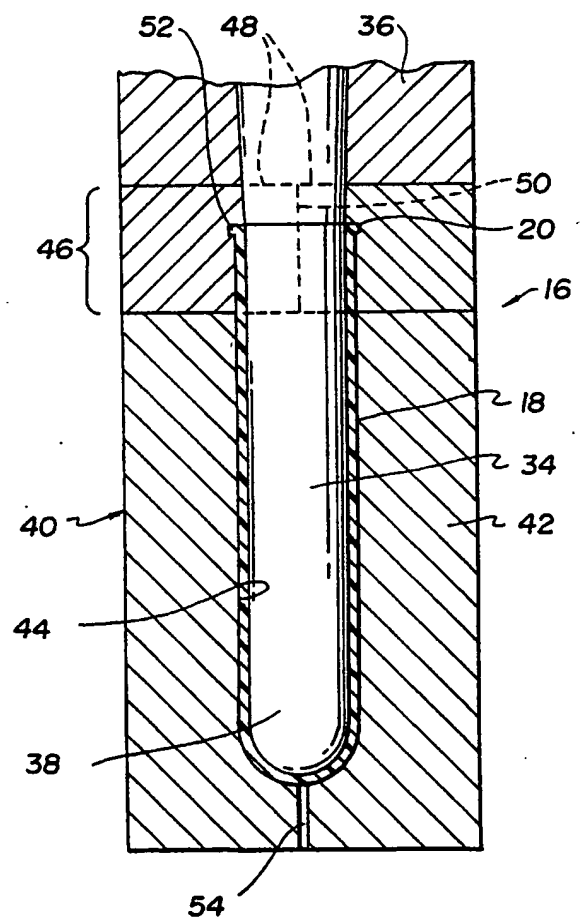
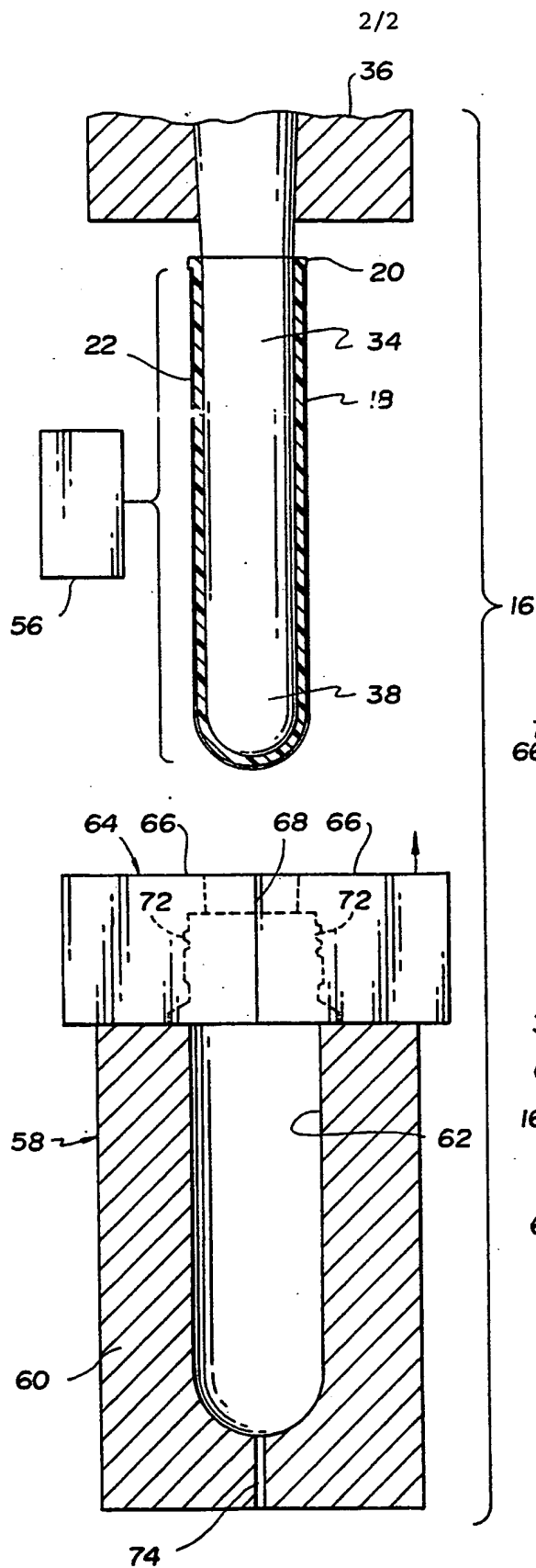
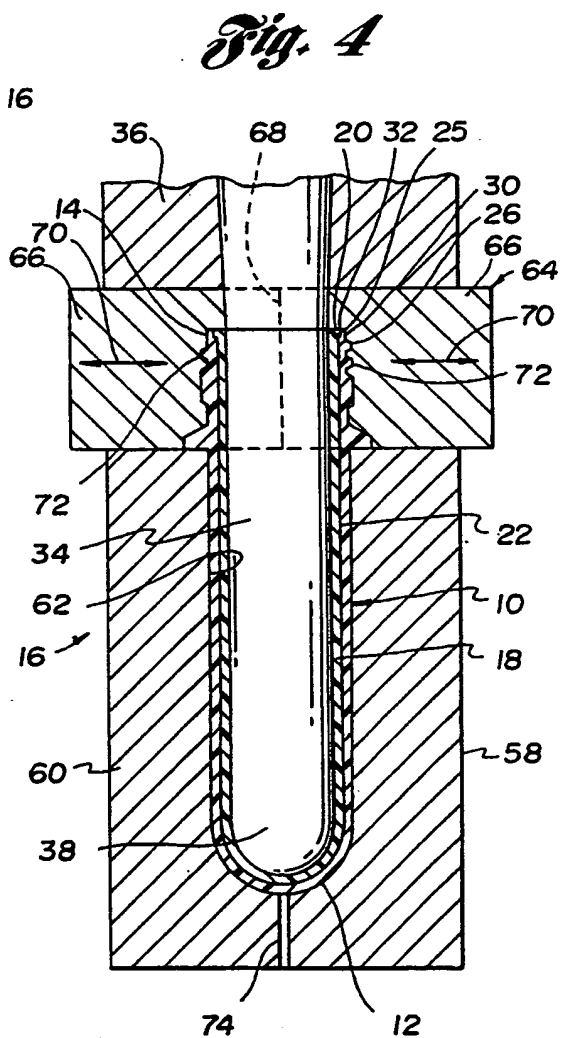


Fig. 1a





*Fig. 3*



*Fig. 4*

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US94/04610

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B32B 1/00

US CL : 428/542.8, 480, 483, 903.3, 35.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 428/542.8, 480, 483, 903.3, 35.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,646,925 (NOHARA) 03 March 1987, column 2, lines 43-61.	1-5
X	US, A, 4,808,482 (BENGE et al) 28 February 1989, see Abstract.	1-5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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